Earthquakes

Profiling Hazard Event

The risk assessment shall include an] overview of the location of all natural hazards that can affect the State, including information on previous occurrences of hazard events as well as the probability of future hazard events, using maps where appropriate.

An earthquake is the result when two blocks of the earth suddenly slip past one another, releasing built-up energy. The surface between these two blocks of earth is referred to as a fault or fault plane. When these blocks move, they produce seismic waves that are transmitted through the rock outwardly in all directions producing ground shaking. Earthquakes are unique multi-hazard events, with the potential to cause huge amounts of damage and loss. Secondary geological effects due to ground shaking include: surface fault rupture, liquefaction and lateral spreading, seiches, tectonic subsidence, landslides and rock falls. Ground shaking also can impact the built environment resulting in fires, possible dam failures, infrastructure damage, hazardous material releases and building damage.

Average Frequency of Earthquakes* in Utah

Magnitude	Average Frequency in State of Utah
≥ 3.0	8 per year
≥ 4.0	1 per year
≥ 5.0	1 every 5 years
≥ 5.5	1 every 10 years
≥ 6.0	1 every 30 years
≥ 7.0	1 every 150 years

≥ Greater than or equal to
*Based on historical record and instrumental monitoring (largest historical shock was M 6.6 in 1934); excludes foreshocks, aftershocks, and human-triggered seismic events.
Source: University of Utah Seismograph Stations

Figure I-12 Earthquake Frequency

The Intermountain Seismic Belt

Utah straddles the physiographic region boundary between the extending Basin and Range Province to the west and the relatively stable Rocky Mountains and the Colorado Plateau to the east. This boundary coincides with an area of earthquake activity called the Intermountain Seismic Belt (ISB). The ISB is a zone of pronounced earthquake activity up to 120 miles wide extending in a north south direction 800 miles from Canada to northern Arizona and eastern Nevada. "Utah's longest and most active fault, the Wasatch fault, lies within the ISB. Unfortunately, the heavily populated Wasatch Front (Ogden-Salt Lake City-Provo urban corridor) and the rapidly growing St. George-Cedar City areas are also with the ISB putting most of Utah's residents at risk."(USSC#)

Earthquake Hazards

In addition to ground shaking, this section will discuss the various geologic hazards that may accompany earthquakes which include: surface fault rupture, liquefaction and lateral spreading, tectonic subsidence, types slope failure, and various types of flooding. Other sections discuss non-earthquake induced landslides and flooding.

Ground Shaking

Ground shaking causes the most impact during an earthquake because it affects large areas and is the origin of many secondary effects associated with earthquakes. Ground shaking, which generally lasts 10 to 30 seconds in large, normal-faulting earthquakes, is caused by the passage of seismic waves generated by earthquakes.

Earthquakes produce both vertical and horizontal ground shaking illustrated in figure I-13. The primary or P waves are compressional; the secondary or S waves have a shear motion. These body waves radiate outwards from the fault to the ground surface where they cause ground shaking. The fast moving P waves are the first waves to cause the vibration of a building. The S waves arrive next often causing a structure to vibrate from side to side. Surface waves, characterized as Rayleigh (R) and Love (L) waves, arrive last, mainly causing low-frequency vibrations. Surface waves are more likely than P and S waves to cause tall buildings to vibrate.

Earthquake waves vary in both frequency and amplitude. High frequency low amplitude waves trigger more damage to short stiff structures, where as low frequency high amplitude waves have a greater effect on tall (high-rise) structures. Ground shaking is measured using Peak Ground Acceleration (PGA). The PGA measures the rate in change of motion relative to the established acceleration due to gravity.

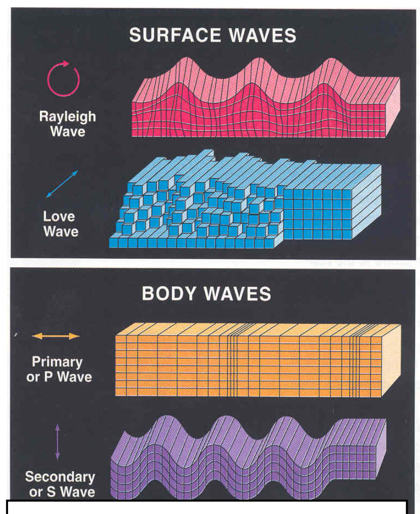


Figure I-13 Seismic waves Courtesy of DCEM

"Earthquakes generate seismic waves at a wide variety of frequencies, and frequency waves may be amplified by local conditions. In the Salt Lake Valley, areas with thick, soft, clayey soil amplify low-frequency seismic waves, yielding slow rolling-type shaking that can damage tall buildings and long span overpasses. Areas with thin, stiff (sandy and gravelly) soil over bedrock amplify high-frequency seismic waves, which yield vigorous ground vibrations that cause more damage to short (1-2 story) buildings, such as houses." (USSC#)

Surface Fault Rupture

During a large earthquake when the two blocks of the earth suddenly slip past one another along the fault plane, the result may be a surface fault rupture, also referred to as a fault scarp. The surface rupture of a steeply dipping fault plane may result in the formation of large fault scarps. Surface fault rupture along the Wasatch fault is expected for earthquakes with magnitudes of 6.5 or larger. The largest credible earthquake that may strike Utah is estimated to be a magnitude 7.0 to 7.5 and is likely occur on the Wasatch Fault. An earthquake of this magnitude, based on current research, would create a fault scarp with a displacement of roughly 6 to 10 feet in height and 20-40 miles

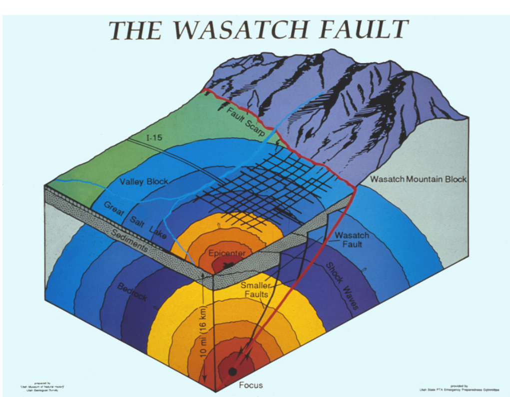


Figure I-14 Wasatch Fault block model. Courtesy of UGS

long. In historic time, a surface fault rupture has only occurred once in Utah; the 1934 Hansel Valley earthquake with a magnitude 6.6 produced 1.6 feet of vertical offset.

Surface fault rupture does not always occur on a single distinct plane. It may occur over a zone sometimes several hundred feet wide known as the zone of deformation. The zone of deformation occurs mainly on the downthrown side of the main fault trace. Frequently, antithetic faults form, moving in the opposite direction of the main fault, creating grabens (down dropped blocks) within the zone of deformation. This down dropping of blocks of earth sometimes lowering and tilting of the near area is called tectonic subsidence.

Figure I-15 Displacement in excavation
Courtesy of UGS

Surface fault rupture and the zone of deformation present significant challenges to the built environment. Anything built on, near, or crossing the fault has a high potential of being significantly damaged. Foundations will be cracked, building torn apart, and roads, utility lines, pipelines, or any other lifelines will be disrupted.

Liquefaction

Soil liquefaction occurs when water-saturated, cohesionless sandy soils are subject to ground shaking. When liquefaction occurs, soils behave more like a viscous liquid (quicksand) and lose their bearing capacity and shear strength. Two conditions must be met in order for soils to liquefy: (1) the soils must be susceptible to liquefaction (sandy, loose, water-saturated, soils typically between 0 and 30 feet below the ground surface) (2) ground shaking must be strong enough to cause susceptible soils to liquefy. The loss of shear strength and bearing capacity due to liquefaction causes buildings to settle or tip and light buoyant structures such as buried storage tanks and empty swimming pools to float upward. Liquefaction can occur during earthquakes of magnitude 5.0 or greater. Recently, liquefaction features were found in the 2010 M4.9 Randolph Earthquake in Rich County.

Lateral Spread

Soils, once liquefied, can flow on slopes with angles of .5 to 5 percent. This movement of liquefied soils is known as lateral spread. "The surficial soil layers break up and sections move independently, and are displaced laterally over a liquefied layer" (Eldredge 10). Liquefaction can cause damage in several way, with lateral spreading being one of the most common. Displacement of three (3) or more feet may occur and be accompanied by ground cracking and vertical displacement. Lateral spreading causes roads, buildings, buried utilities, and any other buried or surface structure to be either compressed or pulled apart.

Various Flooding Issues Related to Earthquakes

Earthquakes could cause flooding due to regional lowering and tilting of the valley floor (tectonic subsidence), dam failure and seiches in lakes and reservoirs. Flooding can also result from the disruption of rivers and streams. Water tanks, pipelines, and aqueducts may be ruptured, or canals and streams altered by ground shaking, surface faulting, ground tilting, and landsliding.

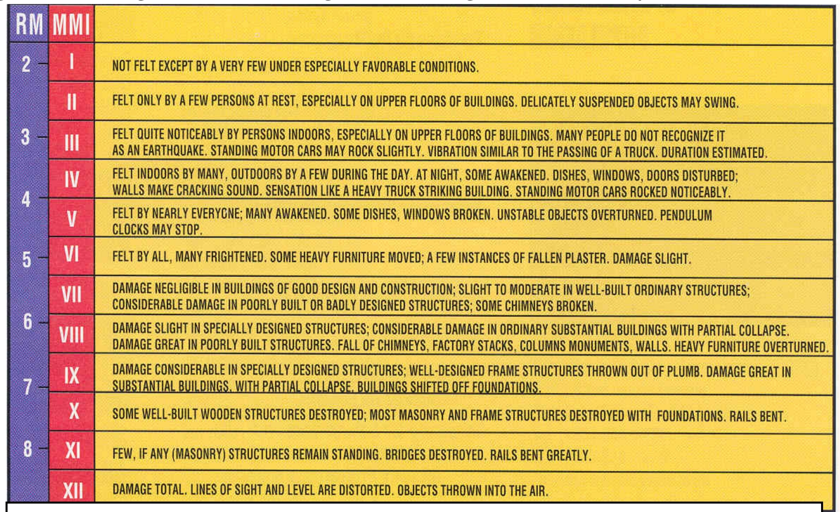


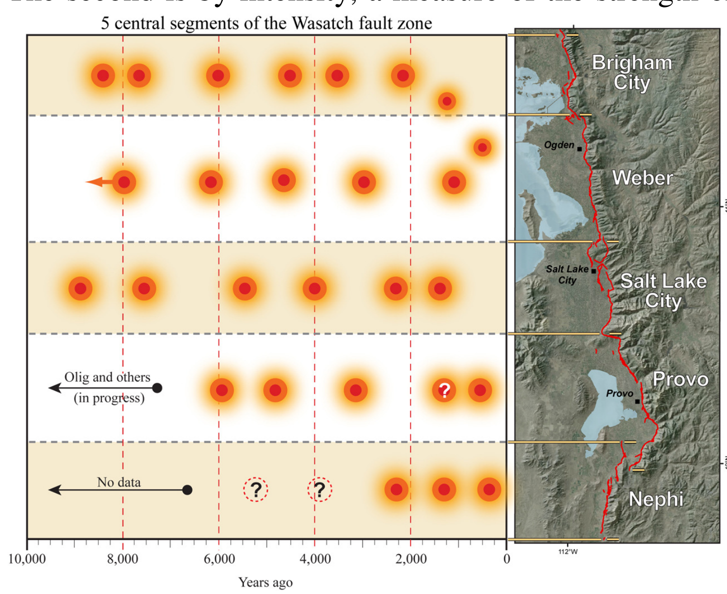
Figure I-16 Comparison between MMI and RM Courtesy of DCEM

Seiches

Standing bodies of water are susceptible to earthquake ground motion. Water in lakes and reservoirs may be set in motion and slosh from one end to the other, much like in a bathtub. This motion is called a seiche (pronounced "saysh"). A seiche may lead to dam failure or damage along shorelines.

Earthquake Measurement

An earthquake's size can be measured in several ways. One way is by magnitude, a measure of the energy released. The second is by intensity, a measure of the strength of gound shaking at a particular, and varies by location, proximity to the sour of the earthquake, and type of material underlying the site. The Richter Magnitude scale, a logarithmic scale where every whole number increase represents a ten-fold increase in recorded ground motion, is used to measure magnitude. The Modified Mercalli Intensity Scale is descriptive scale that ranges from low (I) to high(XII)



Slope Failure

Earthquake-induced landslides, rock falls and other type of slope failure could be triggered by ground shaking. Slope failure is usually confined to mountainous or canyon areas. However, steep ravines and slopes within city limits could also experience slope failure. The extent of slope failure depends upon the severity of ground shaking, steepness of slope, moisture content, and type of soil or rock. If the earthquake occurs in the winter months, snow avalanches may constitute the greatest slope failure hazard.

Significant Earthquakes:

Every year, seismograph stations record about 700 earthquakes occurring in Utah. Most of these are too small to even be felt. Figure I-12 demonstrates the average frequency of earthquakes in Utah. Utah has numerous active faults throughout the state, capable of causing damage, but due to the number of people residing along the Wasatch Front and the amount of infrastructure, an event on the Wasatch Fault would cause the most damage. The last known movement of each segment of the Wasatch Fault is shown in figure I-17. Table I-14 provides a timeline of all earthquakes larger then 5.0 magnitude, occurring in Utah from 1876 to present.

Illustrated in Figures I-18—I-22 are the location of earthquakes from 1850 through 2010 larger than 3.0. These maps provide spatial reference to seismically active areas.

Table I-14 Significant Utah Earthquakes

Date	Name	Magnitude	Intensity
March 22, 1876	Moroni	5.0	VI
December 5, 1887	Kanab	5.7	VII
April 20, 1891	St. George	5.0	VI
July 18, 1894	Ogden	5.0	VI
August 1, 1900	Eureka	5.0 +/- .5	VII
November 13, 1901	Southern Utah	6.0 +/- .5	IX
November 17, 1902	Pine Valley	6.0	VIII
April 15, 1908	Milford	5.0	VI
October 5, 1909	Hansel Valley	6.0	VIII
January 10, 1910	Elsinore	5.0	VI
May 22, 1910	Salt Lake City	5.5	VII
May 13, 1914	Ogden	5.0 +/- .5	VII
July 15, 1915	Provo	5.0	VI
September 29, 1921	Elsinore	6.0	VIII
January 20, 1933	Parowan	5.0	VI
March 12, 1934	Hansel Valley	6.6	IX
August 30, 1942	Cedar City	5.0	VI
September 26, 1942	Cedar City	5.0	VI
February 22, 1943	Magna	5.0	VI
November 17, 1945	Glenwood	5.0	VI
March 6, 1949	Salt Lake City	5.0	VI
February 13, 1958	Wallsburg	5.0	VI
February 27, 1959	Panquitch	5.0	VI
July 21, 1959	Southwest	5.7	VI
April 15, 1961	Ephraim	5.0	VI
August 30, 1962	Cache Valley	5.7	VII
September 5, 1962	Magna	5.2	VI
October 4, 1967	Marysvale	5.2	VII
March 27, 1975	Pocatello Valley, ID*	6.0	VIII
August 14, 1988	San Rafael Swell	5.3	VI
January 29, 1989	Wasatch Plateau	5.4	VI
September 2, 1992	St. George	5.8	VII

*Occurred in Idaho, felt in throughout northern Utah
Table derived form information provided by the University of Utah Seismograph Stations http://www.seis.utah.edu/lqthreat/nehrp_htm/eqtbl-date.shtml

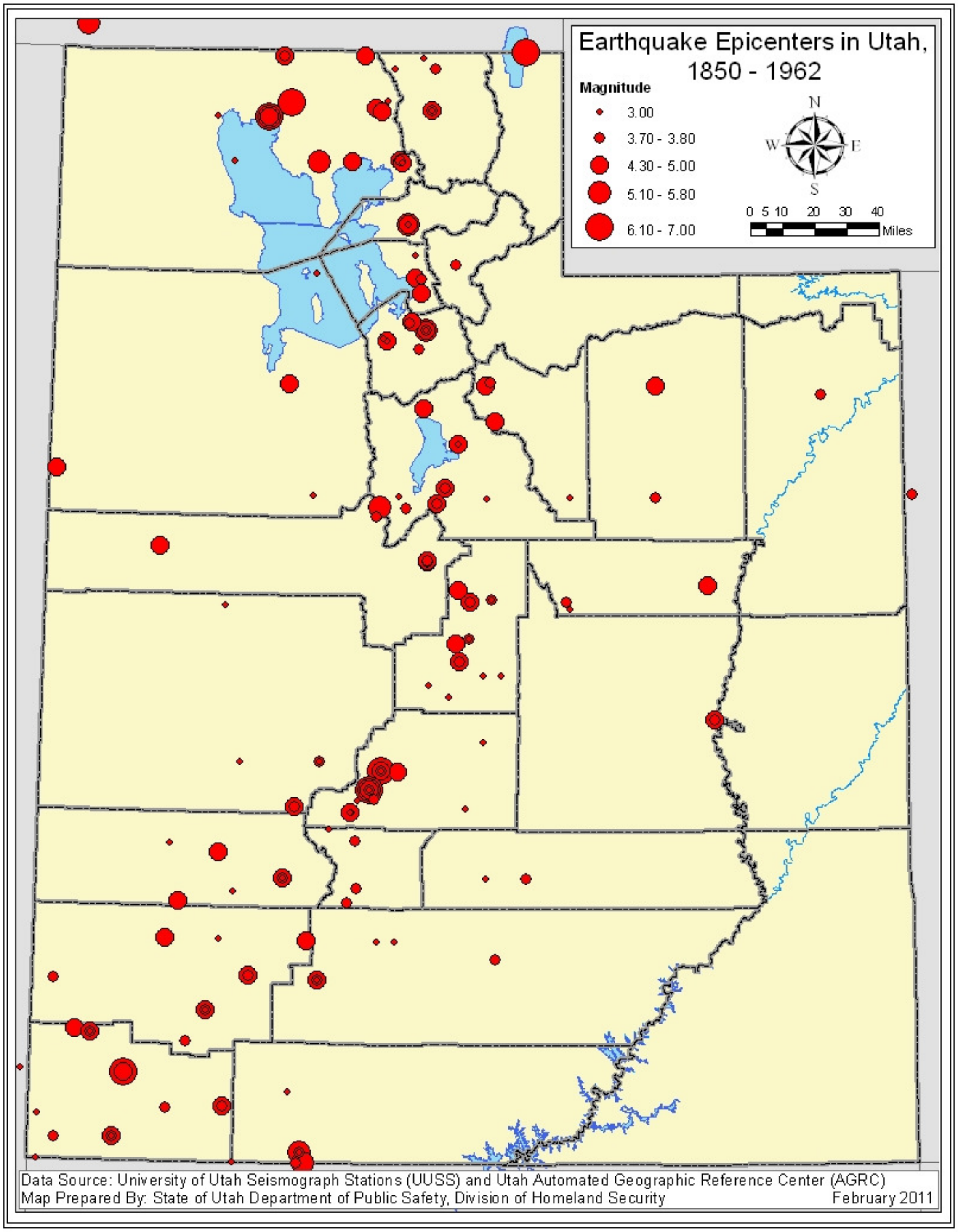


Figure I-18

*Epicenters represented here are derived from the historic catalog at the University of Utah Seismograph Stations database. The year 1850 represents the year of the first publication of a newspaper in the state of Utah.

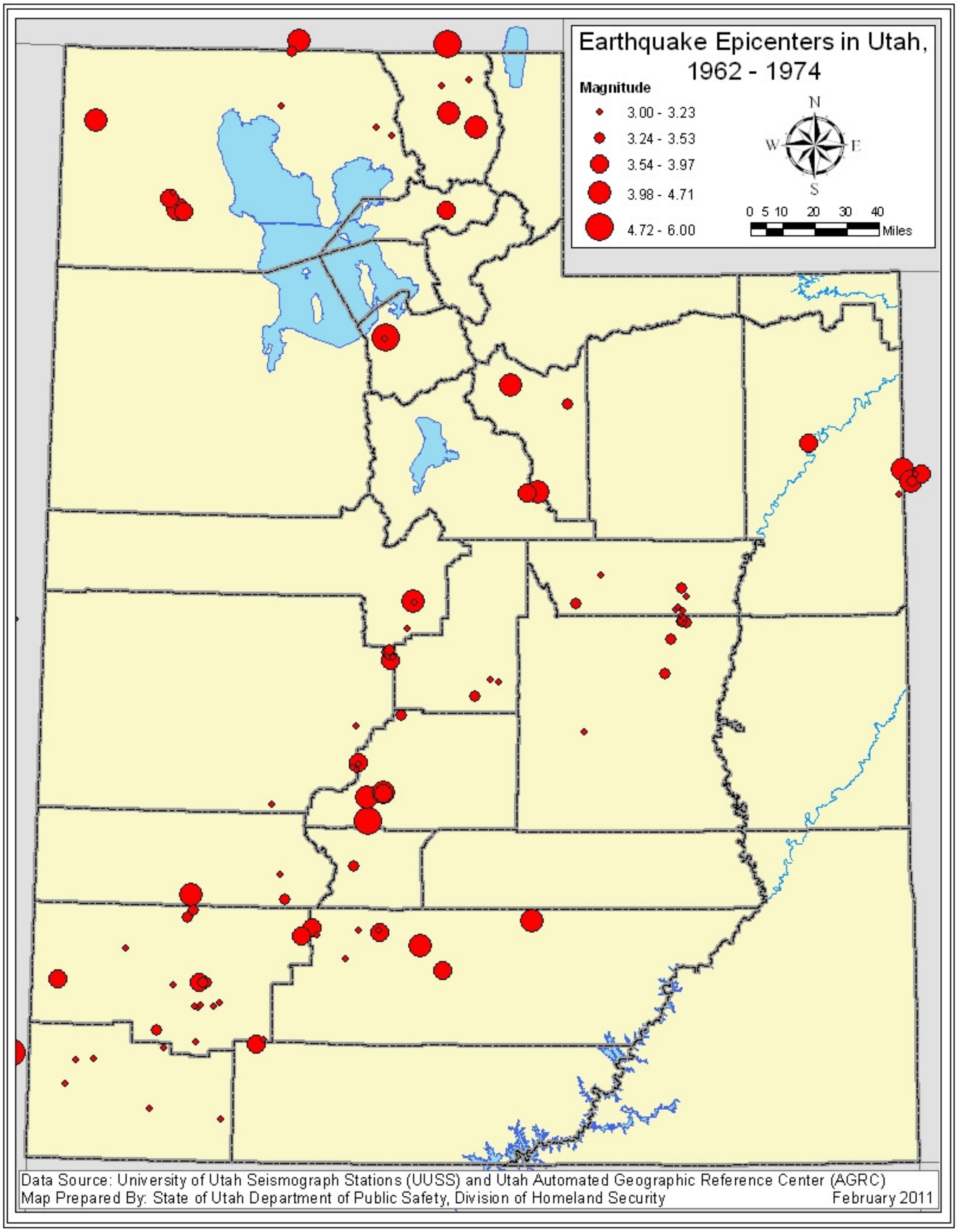

Earthquake Epicenters in Utah, 1962 - 1974
Magnitude
3.00 - 3.23
3.24 - 3.53
3.54 - 3.97
3.98 - 4.71
4.72 - 6.00
N
W
E
S
0 5 10 20 30 40
Miles
Data Source: University of Utah Seismograph Stations (UUSS) and Utah Automated Geographic Reference Center (AGRC)
Map Prepared By: State of Utah Department of Public Safety, Division of Homeland Security
February 2011

Figure I-19

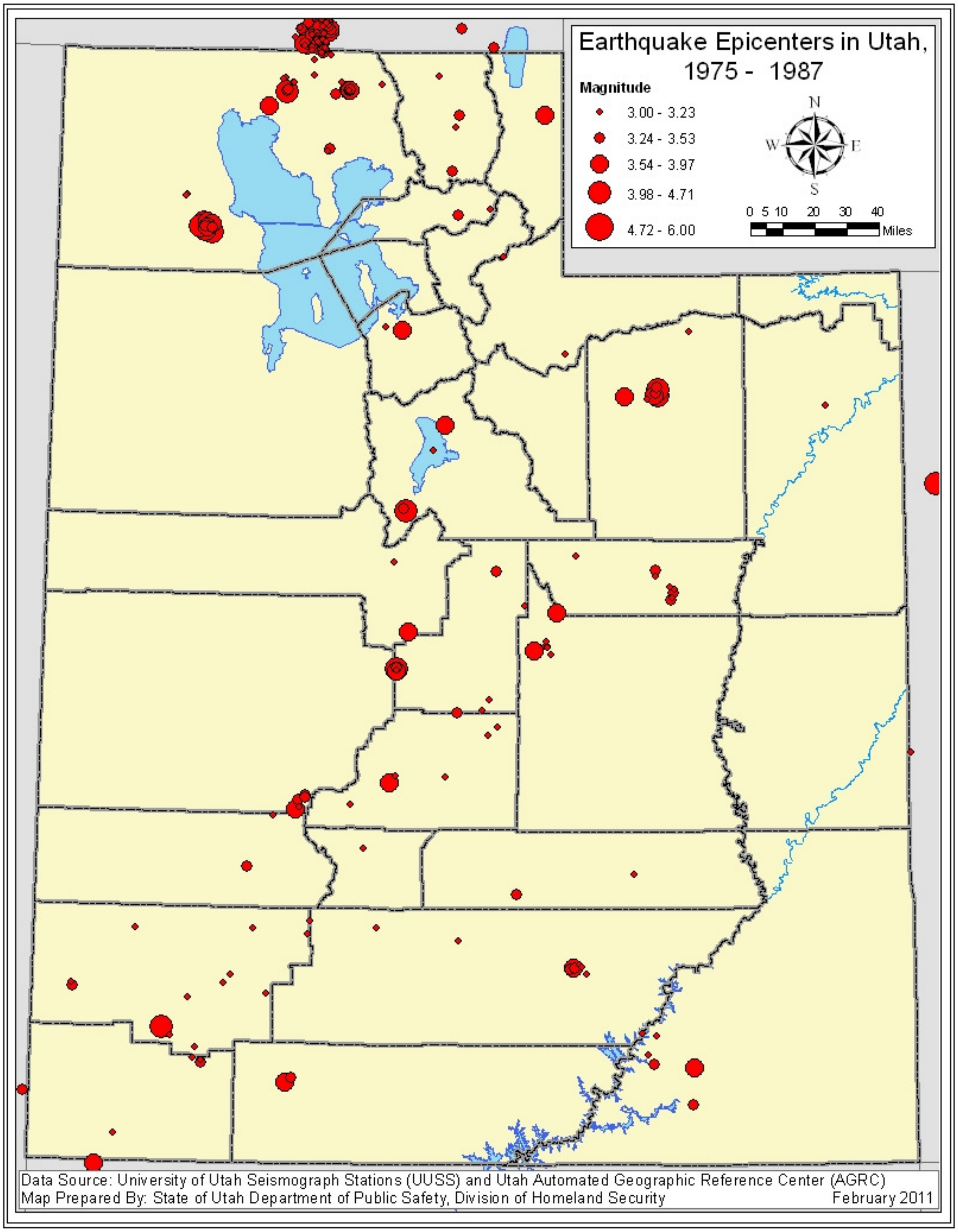


Figure I-20

*Magnitudes of earthquakes occurring after 1981 have been revised by the University of Utah Seismograph Stations as noted at: http://www.quake.utah.edu/EQCENTER/LISTINGS/magsum.htm

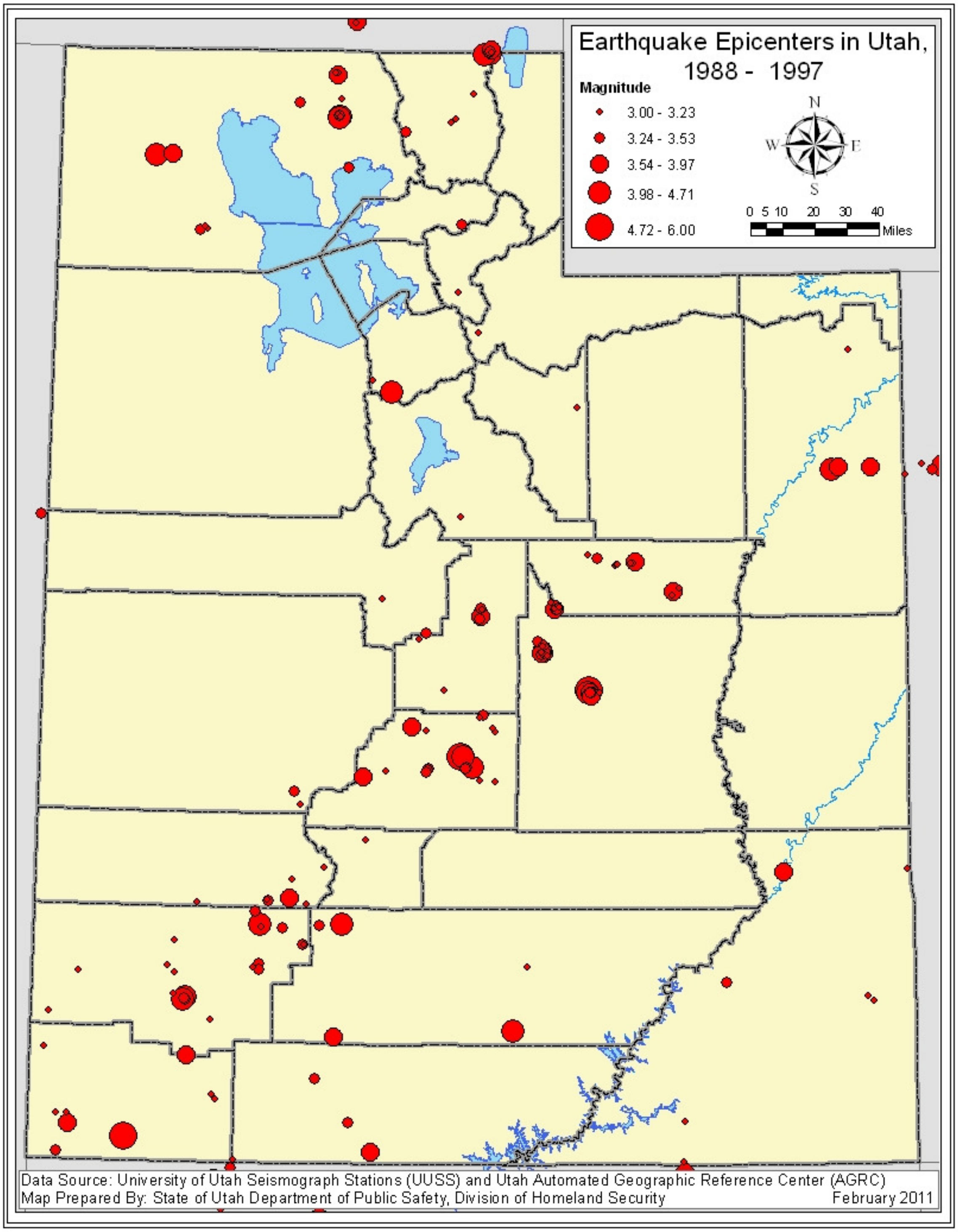


Figure I-21

*Magnitudes of earthquakes occurring after 1981 have been revised by the University of Utah Seismograph Stations as noted at: http://www.quake.utah.edu/EQCENTER/LISTINGS/magsum.htm

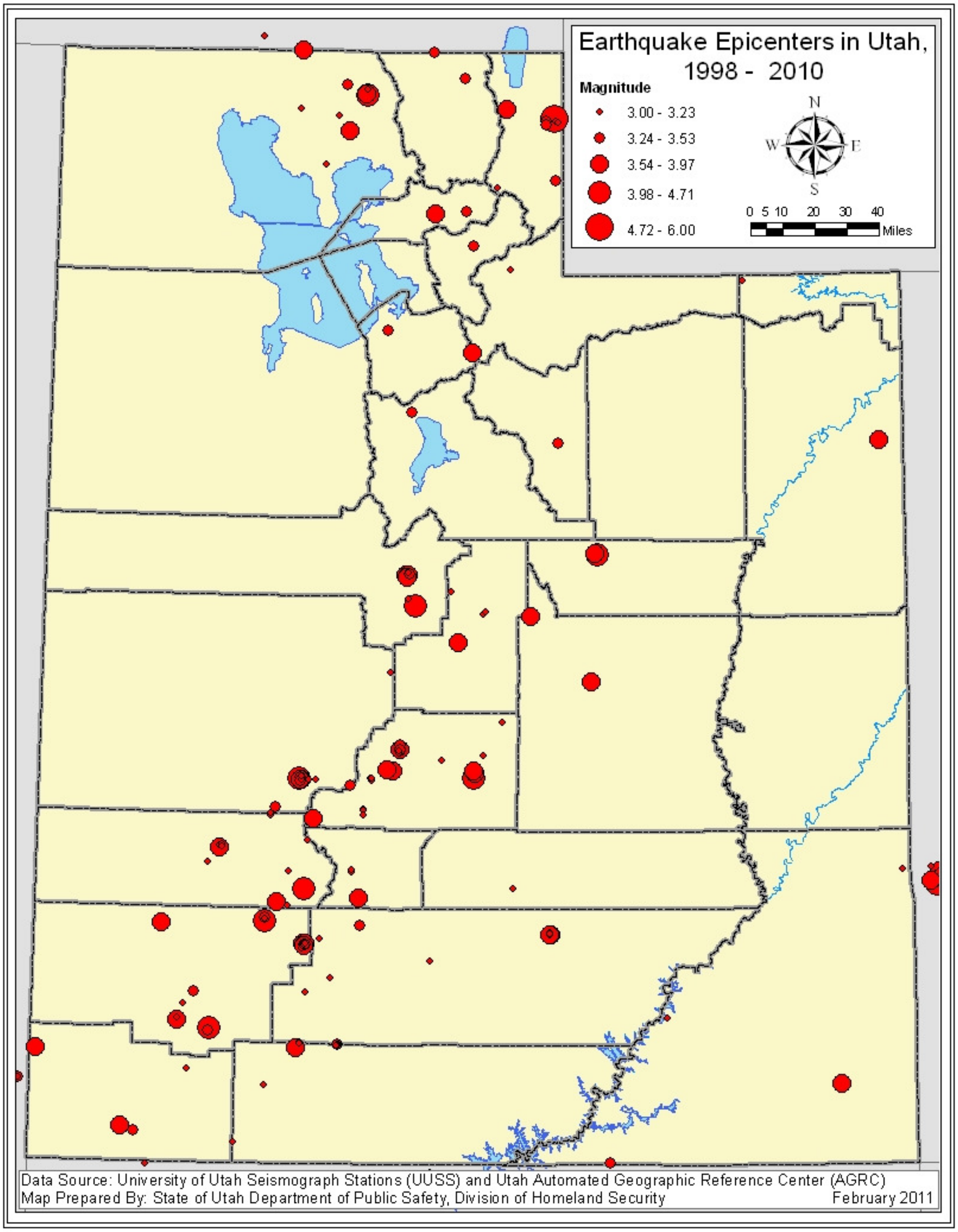


Figure I-22

*Magnitudes of earthquakes occurring after 1981 have been revised by the University of Utah Seismograph Stations as noted at: http://www.quake.utah.edu/EQCENTER/LISTINGS/magsum.htm

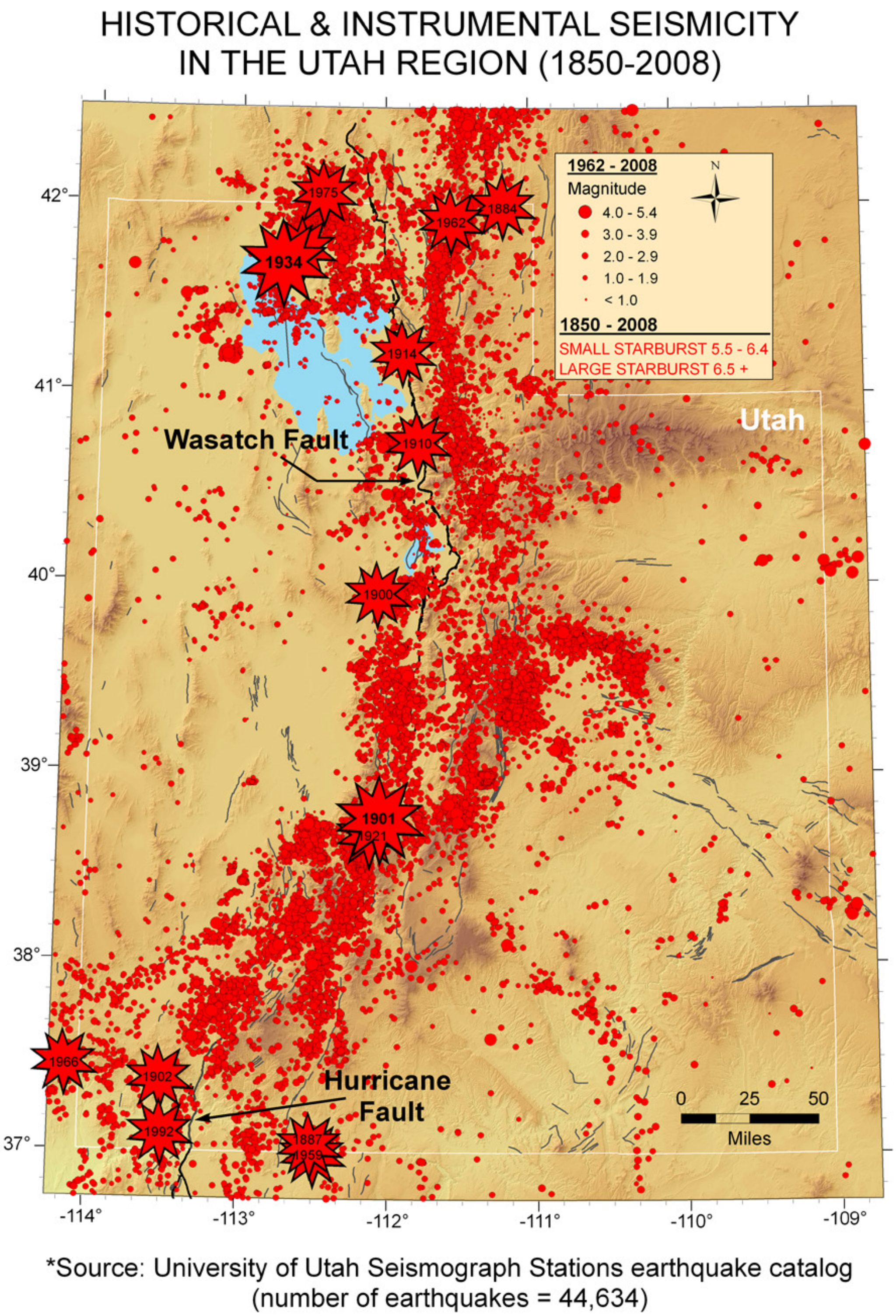

HISTORICAL & INSTRUMENTAL SEISMICITY
IN THE UTAH REGION (1850-2008)
1962 - 2008
Magnitude
4.0 - 5.4
3.0 - 3.9
2.0 - 2.9
1.0 - 1.9
< 1.0
1850 - 2008
SMALL STARBURST 5.5 - 6.4
LARGE STARBURST 6.5 +
N
Utah
Wasatch Fault
Hurricane Fault
1975
1934
1962
1884
1914
1910
1900
1901
1921
1966
1902
1992
1887
1959
42°
41°
40°
39°
38°
37°
-114°
-113°
-112°
-111°
-110°
-109°
0
25
50
Miles
*Source: University of Utah Seismograph Stations earthquake catalog
(number of earthquakes = 44,634)

Figure I-23

Utah Quaternary Fault Map 2002 - Utah Geological Survey

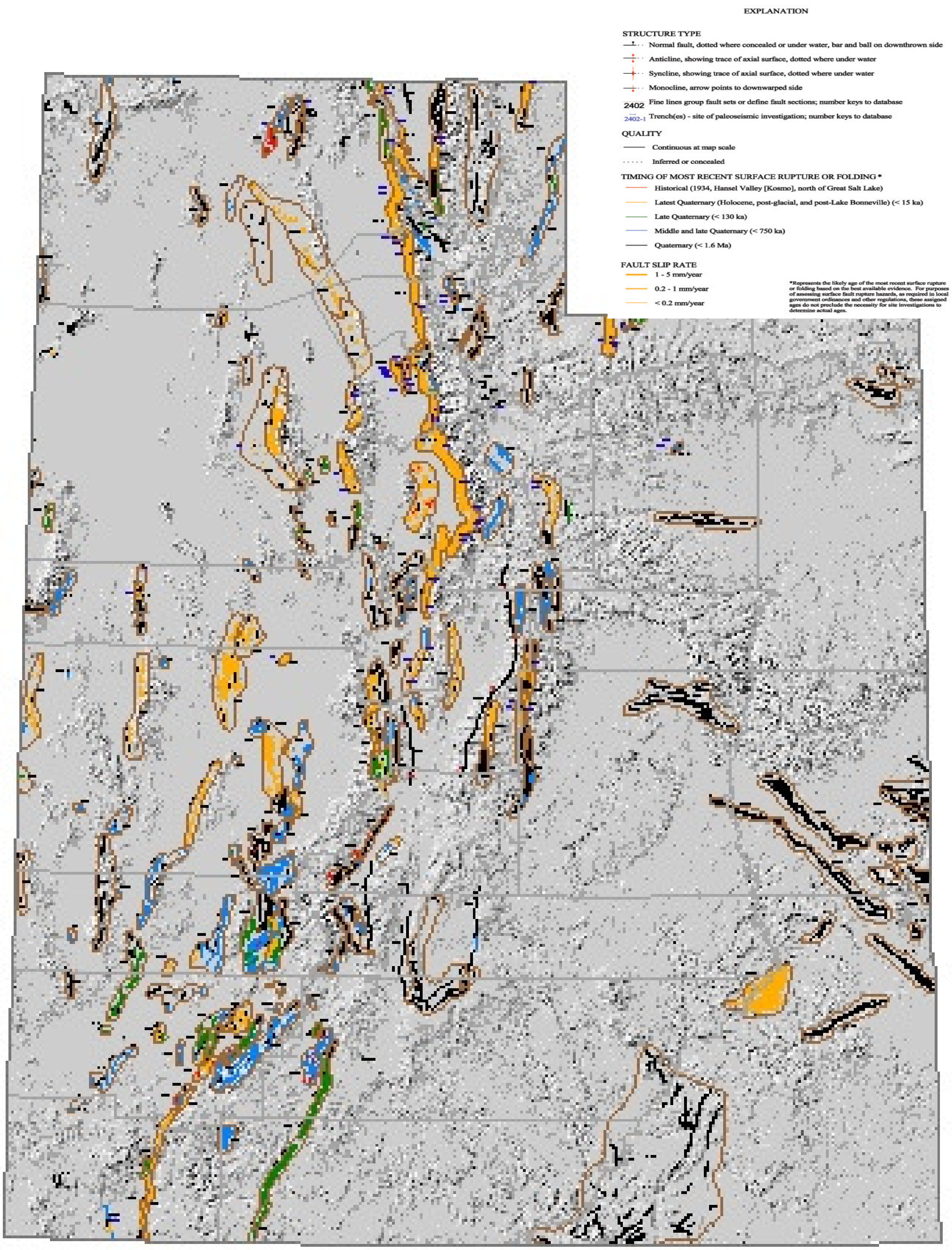
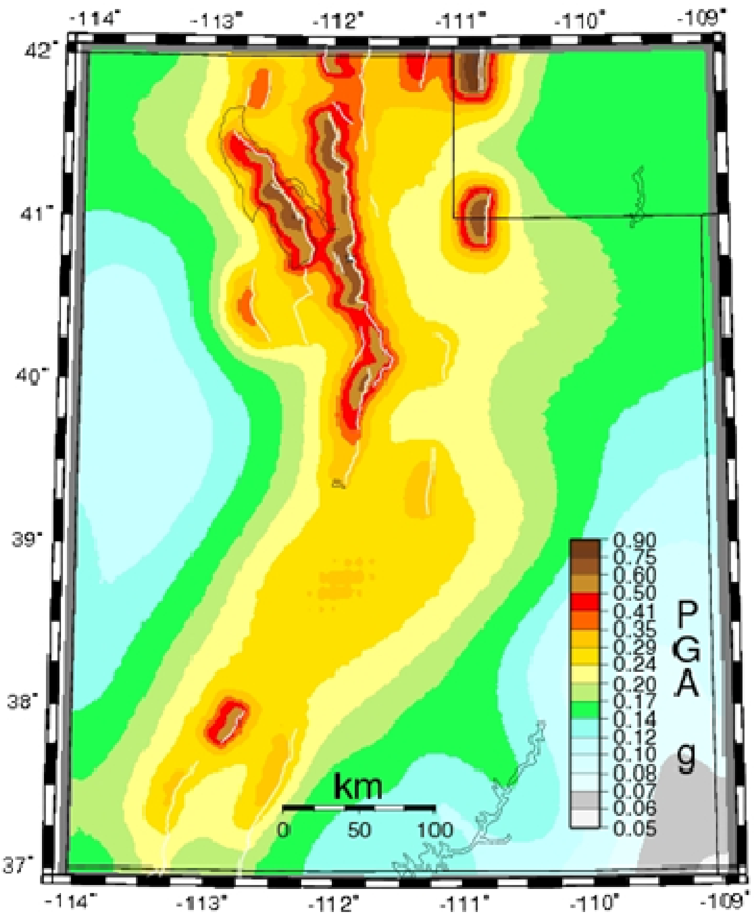


Figure I- 24
<u>Peak Acceleration</u> (%g) with a Probability of Exceedance in 50 Years
Source: (http://earthquake.usgs.gov/hazards/apps/cmaps/)



The U.S. Geological Survey has developed and periodically updates its National Seismic Hazard Maps. These maps illustrated probabilistic ground motion for Peak Ground Acceleration (PGA) and various spectral accelerations (SA).

The standard for evaluating the ground motion hazard is a 2% in 50 year probability of exceedence for PGA. The PGA values applicable to Utah are shown on the following map. The contour values show the probabilistic ground motions expressed in a percentage of gravity.

It must be noted that there are limitations to these hazards maps. The maps are based only on data from published faults. There may be many more faults that could contribute to the ground motion hazard that are not currently reflected on the maps.

Areas of the state that are at risk to the seismic hazard included the Logan Metro Area, the Ogden-Salt Lake-Provo Metro Area, the Cedar City Metro Area and the St. George

Metro Area. The ground motions in these are Metro Areas may be perceived as strong to violent with light to heavy damage potential.

These areas are population centers and are experiencing some of the greatest growth in the state. Without earthquake mitigation which goes beyond adopting current and future building codes to lesson or eliminate the effects of ground motion on the built environment, the potential losses will increase as population growth, building and development expands.

Assessing Vulnerability by Jurisdiction

> *[The risk assessment shall include] an overview and analysis of the State's vulnerability to the hazards described in this paragraph (c)(2), based on estimates provided in local risk assessments... The State shall describe vulnerability in terms of the jurisdictions most threatened by the identified hazards, and most vulnerable to damage and loss associated with hazard events…*

Earthquakes will continue to occur in Utah. The precise time, location and magnitude of future earthquakes cannot be predicted. Earthquake hazard areas in Utah are concentrated along the Intermountain Seismic Belt (ISB).

The ISB is a zone of pronounced earthquake activity up to 120 miles wide extending in a north south direction 800 miles from Canada to northern Arizona and eastern Nevada. "Utah's longest and most active fault, the Wasatch fault, lies within the ISB. The heavily populated Wasatch Front (Ogden-Salt Lake City-Provo urban corridor) and the rapidly growing St. George-Cedar City areas are also with the ISB putting most of Utah's residents at risk." *(USSC#)*

Numerous factors contribute to determining areas of vulnerability. Key factors include historical earthquake activity, proximity to faults, soil characteristics, building construction, and population density.

Earthquake Hazard Areas

The U.S. Geological Survey (USGS) has developed earthquake hazard maps showing ground acceleration for the United States. The peak acceleration values applicable to Utah are shown in Figure 1-24. The contour values show the earthquake ground motions with acceleration expressed as a percentage of the acceleration of gravity with a two-percent probability of being exceeded in fifty years.

Areas of the state that are at risk to the seismic hazard included the Logan Metro Area, the Ogden-Salt Lake-Provo Metro Area, the Cedar City Metro Area and the St. George Metro Area. The ground motions in these are Metro Areas may be perceived as strong to violent with light to heavy damage potential.

These areas are population centers and are experiencing some of the greatest growth in the state. Without earthquake mitigation which goes beyond adopting current and future building codes to lesson or eliminate the effects of ground motion on the built environment, the potential losses will increase as population growth, building and development expands.

County vulnerability ranking is solely based on the total building related economic loss that would occur from a 2500-year seismic event in each county. Population and population density in these counties also supports this ranking.

1. Salt Lake
2. Utah
3. Davis
4. Weber
5. Washington
6. Cache
7. Summit
8. Tooele
9. Box Elder
10. Iron
11. Uintah
12. Carbon
13. Sanpete
14. Sevier
15. Wasatch
16. Duchesne
17. San Juan
18. Millard
19. Emery
20. Grand
21. Kane
22. Garfield
23. Juab
24. Morgan
25. Beaver
26. Rich
27. Wayne
28. Piute
29. Daggett

Estimating Potential Losses by Jurisdiction

[The risk assessment shall include an] overview and analysis of potential losses to identified vulnerable structures, based on estimates provided in local risk assessments…

HAZUS MH, a model developed by FEMA to replicate earthquake loss, was used to estimate vulnerability. HAZUS MH was used to model ground-shaking levels with a 2500-year return period for each county. Compiled in table I-15 are some of the more pertinent loss values, from the HAZUS MH runs.

Table I-15 County Earthquake Loss Value from HAZUS MH

FEMA HAZUS EARTHQUAKE Direct Economic Losses For Buildings			
Damage	**Building Damage**	**Non-Structural Damage**	**Total $$ Loss**
County			
Utah	$1,417	$5,018	$10,801
Wayne	$3	$8	$21
Sanpete	$45	$154	$352
Washington	$254	$723	$1,740
Beaver	$17	$53	$126
Wasatch	$43	$146	$319
Box Elder	$203	$689	$1,474
Sevier	$44	$148	$333
Emery	$22	$63	$146

Piute	$6	$17	$42
Kane	$14	$38	$100
Tooele	$101	$349	$738
Carbon	$38	$110	$274
Grand	$4	$11	$32
Salt Lake	$7,033	$25,274	$54,212
Juab	$20	$66	$151
Weber	$1,089	$3,812	$8,127
Summit	$138	$507	$1,098
Cache	$391	$1,368	$2,989
Duchesne	$21	$53	$133
Morgan	$21	$71	$157
Rich	$15	$53	$106
Davis	$1,362	$4,787	$10,006
Millard	$17	$52	$121
Uintah	$21	$55	$137
Daggett	$2	$4	$11
Garfield	$18	$60	$155
Iron	$153	$472	$1,094
San Juan	$3	$7	$19
State of Utah	$12,516	$44,170	$95,016
Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/states were selected at the time of study region creation.			
Study Region : Utah State Annualized MR-4	*All values are in thousands of dollars*	*Scenario : Annualized Loss-2008 Ground Motions*	*Earthquake Hazard Report*

Assessing Vulnerability by State Facilities

[The risk assessment shall include an] overview and analysis of the State's vulnerability to the hazards described in this paragraph (c)(2), based on estimates provided in …the State risk assessment. …State owned critical or operated facilities located in the identified hazard areas shall also be addressed…

When assessing the vulnerability of state owned facilities, or all facilities for that matter, an understanding of the building code, to which the building was designed, is of extreme importance. Utah building codes began to address seismic design as early as 1975 although the state did not adopt building codes fully addressing seismic safety until 1989. It is a fairly safe assumption that buildings constructed prior to 1975 will not perform in an earthquake as well as those building constructed since 1975. An increased understanding of seismic events coupled with advances in building design has greatly increased our ability to design and construct buildings that perform better in earthquakes. Safer buildings are a result of scientific gains in the fields of geoscience and structural engineering being accepted and put in practice through building codes. Thus, buildings constructed today will have a superior performance in an earthquake than those constructed in the past.

Earthquakes are regional hazards effecting multi-county areas, and because almost the entire state could experience a seismic event, all of the state owned buildings exhibit some degree of risk due to the event. The degree of risk is determined by several factors none more important than the likelihood and potential magnitude of the earthquake, although when discussing potential building damage regardless of location, building design is a key factor. Vulnerability of state owned facilities was determined through age of construction with those buildings built before 1975 considered having a higher risk. Shown in table I-16 is the number of state buildings in each county built prior to1975 and those built since 1975.

Table I-16 Number of State Owned Facilities per County Built pre-1975 and since 1975

County Name	Number of state owned buildings considered high risk pre 1975 construction date	Number of state owned buildings considered to have a lower risk since 1975 construction date
Beaver	17	26
Box Elder	63	72
Cache	266	320
Carbon	53	82
Daggett	13	16
Davis	117	235
Duchesne	22	80
Emery	32	79
Garfield	28	47
Grand	44	35
Iron	67	163
Juab	23	50
Kane	24	47
Millard	24	61
Morgan	19	48
Piute	8	16
Rich	16	47
Salt Lake	811	1,410
San Juan	33	71
Sanpete	45	144
Sevier	35	92
Summit	23	120
Tooele	31	63
Uintah	41	90
Utah	189	436
Wasatch	21	135
Washington	51	201
Wayne	29	7
Weber	193	205
Total	2,339	4,397

Estimating Potential Losses by State Facilities

[The risk assessment shall include the following:]…[a]n overview and analysis of potential losses to identified vulnerable structures, based on estimates provided in …the State risk assessment. The State shall estimate the potential dollar losses to State-owned or operated buildings, infrastructure, and critical facilities located in the identified hazard areas.

To estimate the potential losses a seismic event would cause to state owned facilities, age of construction was again a central element. This time the construction date of a building was utilized to determine the value or expected damage as based on the building's insured value. To determine the value of vulnerable state-owned facilities, the state-owned building database was queried to identify the number of buildings, age of building construction, and insured value of those buildings for each county. The insured value was then used to determine estimated building damage that would result from an event with ground motion of 0.25 and 0.55 PGA.

Loss estimation tables from FEMA publication 386-2 "Understanding Your Risk - Identifying Hazards and Estimating Losses" were utilized to obtain the percentage of damage expected at the two different PGA values. Rather than determine the building type of all 6,736 state-owned facilities the values in Table I-17 are for apartment buildings. This building type seemed most similar to the majority of state-owned facilities. We assumed moderate building code construction for reinforced masonry structures built during and after 1975 and pre-code construction for unreinforced masonry structures built before 1975. Damage estimates for structures built before 1975 assume 12.6% damage at 0.25 PGA and 43.7% damage at 0.55 PGA. Damage estimates for structures built since 1975 assume 4.0% damage at 0.25 PGA and 24.5% damage at 0.55 PGA. Content values were not figured into table I-17, as they are most likely included in the insured value. This may have slightly increased the expected damage because as a rule content valued is one half of the expected building damage. For example, building damage for pre-code construction in an unreinforced masonry structure with a ground motion event of 0.55 PGA has an estimated percent damage of 43.7. One would estimate that the contents damage would be 21.85% of the building's replacement value.

Table I-17 Potential Damage to State Owned Facilities

County Name	Buildings (Year Built)	Count	Insured Value	Expected Building damage at 0.25 PGA (g)	Expected Building damage at 0.55 PGA (g)
Beaver	Pre-1975	17	$19,354,733	$2,438,696.36	$8,458,018.32
	1975 - 2010	26	$40,303,972	$1,612,159	$9,874,473.14
	Total	43	$59,658,705	$4,050,855.24	$18,332,491.46
Box Elder	Pre-1975	63	$245,074,656	$30,879,406.67	$107,097,624.72
	1975 - 2010	72	$138,996,886	$5,559,875	$34,054,237.05
	Total	135	$384,071,542	$36,439,282.10	$141,151,861.76
Cache	Pre-1975	266	$782,311,945	$98,571,305.08	$341,870,320.00
	1975 - 2010	320	$738,571,580	$29,542,863	$180,950,037.08

	Total	586	$1,520,883,525	$128,114,168.28	$522,820,357.08
Carbon	Pre-1975	53	$87,030,976	$10,965,902.98	$38,032,536.51
	1975 - 2010	82	$121,235,919	$4,849,437	$29,702,800.16
	Total	135	$208,266,895	$15,815,339.74	$67,735,336.67
Daggett	Pre-1975	13	$7,668,228	$966,196.69	$3,351,015.49
	1975 - 2010	16	$7,453,111	$298,124	$1,826,012.28
	Total	29	$15,121,339	$1,264,321.14	$5,177,027.77
Davis	Pre-1975	117	$694,988,971	$87,568,610.30	$303,710,180.18
	1975 - 2010	235	$778,240,419	$31,129,617	$190,668,902.74
	Total	352	$1,473,229,390	$118,698,227.08	$494,379,082.92
Duchesne	Pre-1975	22	$55,733,517	$7,022,423.11	$24,355,546.80
	1975 - 2010	80	$107,110,176	$4,284,407	$26,241,993.19
	Total	102	$162,843,693	$11,306,830.16	$50,597,539.99
Emery	Pre-1975	32	$51,628,364	$6,505,173.91	$22,561,595.21
	1975 - 2010	79	$59,870,375	$2,394,815	$14,668,241.79
	Total	111	$111,498,739	$8,899,988.89	$37,229,837.01
Garfield	Pre-1975	28	$24,790,364	$3,123,585.82	$10,833,388.93
	1975 - 2010	47	$31,295,092	$1,251,804	$7,667,297.62
	Total	75	$56,085,456	$4,375,389.52	$18,500,686.55
Grand	Pre-1975	44	$28,858,420	$3,636,160.89	$12,611,129.44
	1975 - 2010	35	$20,310,570	$812,423	$4,976,089.70
	Total	79	$49,168,990	$4,448,583.70	$17,587,219.15
Iron	Pre-1975	67	$158,324,566	$19,948,895.32	$69,187,835.35
	1975 - 2010	163	$383,750,386	$15,350,015	$94,018,844.57
	Total	230	$542,074,952	$35,298,910.76	$163,206,679.92
Juab	Pre-1975	23	$16,292,787	$2,052,891.22	$7,119,948.11
	1975 - 2010	50	$70,365,168	$2,814,607	$17,239,466.05
	Total	73	$86,657,955	$4,867,497.92	$24,359,414.16
Kane	Pre-1975	24	$32,072,839	$4,041,177.67	$14,015,830.50
	1975 - 2010	47	$27,693,997	$1,107,760	$6,785,029.35
	Total	71	$59,766,836	$5,148,937.57	$20,800,859.84
Millard	Pre-1975	24	$33,955,982	$4,278,453.76	$14,838,764.24
	1975 - 2010	61	$117,737,845	$4,709,514	$28,845,771.97
	Total	85	$151,693,827	$8,987,967.55	$43,684,536.20
Morgan	Pre-1975	19	$27,208,385	$3,428,256.52	$11,890,064.28
	1975 - 2010	48	$44,052,165	$1,762,087	$10,792,780.40
	Total	67	$71,260,550	$5,190,343.12	$22,682,844.69
Piute	Pre-1975	8	$11,020,983	$1,388,643.86	$4,816,169.57
	1975 - 2010	16	$6,097,985	$243,919	$1,494,006.33
	Total	24	$17,118,968	$1,632,563.26	$6,310,175.90
Rich	Pre-1975	16	$11,858,905	$1,494,222.00	$5,182,341.39
	1975 - 2010	47	$10,722,695	$428,908	$2,627,060.33
	Total	63	$22,581,600	$1,923,129.81	$7,809,401.72
Salt Lake	Pre-1975	811	$3,674,515,643	$462,988,971.04	$1,605,763,336.08
	1975 - 2010	1410	$5,569,461,498	$222,778,460	$1,364,518,066.96
	Total	2221	$9,243,977,141	$685,767,430.95	$2,970,281,403.04
San Juan	Pre-1975	33	$73,651,362	$9,280,071.62	$32,185,645.24
	1975 - 2010	71	$81,723,457	$3,268,938	$20,022,246.94

	Total	104	$155,374,819	$12,549,009.90	$52,207,892.18
Sanpete	Pre-1975	45	$77,243,779	$9,732,716.15	$33,755,531.40
	1975 - 2010	144	$322,937,816	$12,917,513	$79,119,764.93
	Total	189	$400,181,595	$22,650,228.79	$112,875,296.33
Sevier	Pre-1975	35	$50,390,986	$6,349,264.23	$22,020,860.85
	1975 - 2010	92	$144,379,122	$5,775,165	$35,372,884.91
	Total	127	$194,770,108	$12,124,429.11	$57,393,745.76
Summit	Pre-1975	23	$11,924,260	$1,502,456.75	$5,210,901.58
	1975 - 2010	120	$274,732,497	$10,989,300	$67,309,461.79
	Total	143	$286,656,757	$12,491,756.63	$72,520,363.37
Tooele	Pre-1975	31	$128,233,265	$16,157,391.40	$56,037,936.86
	1975 - 2010	63	$197,031,179	$7,881,247	$48,272,638.83
	Total	94	$325,264,444	$24,038,638.56	$104,310,575.68
Uintah	Pre-1975	41	$68,286,538	$8,604,103.79	$29,841,217.11
	1975 - 2010	90	$164,161,149	$6,566,446	$40,219,481.51
	Total	131	$232,447,687	$15,170,549.75	$70,060,698.61
Utah	Pre-1975	189	$774,045,803	$97,529,771.13	$338,258,015.73
	1975 - 2010	436	$2,100,121,502	$84,004,860	$514,529,768.09
	Total	625	$2,874,167,305	$181,534,631.22	$852,787,783.82
Wasatch	Pre-1975	21	$29,211,560	$3,680,656.60	$12,765,451.87
	1975 - 2010	135	$149,396,808	$5,975,872	$36,602,217.88
	Total	156	$178,608,368	$9,656,528.91	$49,367,669.74
Washington	Pre-1975	51	$100,970,925	$12,722,336.60	$44,124,294.39
	1975 - 2010	201	$713,100,239	$28,524,010	$174,709,558.46
	Total	252	$814,071,164	$41,246,346.14	$218,833,852.85
Wayne	Pre-1975	29	$14,536,903	$1,831,649.83	$6,352,626.78
	1975 - 2010	7	$2,540,491	$101,620	$622,420.20
	Total	36	$17,077,394	$1,933,269.45	$6,975,046.98
Weber	Pre-1975	193	$887,018,379	$111,764,315.81	$387,627,031.83
	1975 - 2010	205	$708,045,208	$28,321,808	$173,471,075.84
	Total	398	$1,595,063,587	$140,086,124.11	$561,098,107.67
OVERALL TOTAL	**All Buildings**	**6736**	**$21,309,643,331**	**$3,107,371,703.47**	**$13,563,823,086**
	Pre-1975	**2339**	**$8,178,204,025**	**$2,943,014,626.29**	**$12,847,586,394**

Damage estimates utilized tables from FEMA 386-2, page 4-18. The state building database was obtained from the Utah Department of Administrative Services, Division of Risk Management. The insured value of each building is based on the value of each building for the fiscal year (FY) 2010. The building database includes K-12 schools as well as facilities for colleges and universities.

Local Jurisdiction Loss Estimates

Local jurisdictions also produce loss estimations for an earthquake event. These loss estimations are typically included in hazard mitigation plans produced by the metropolitan planning organization (MPO) in which local jurisdiction resides. The tables shown in this section are taken from the most recent hazard mitigation plan from the Bear River Association of Governments (BRAG). The earthquake loss estimates are typically derived on a countywide basis. Some counties elect to produce loss estimates for each jurisdiction in the county, while others only report loss estimates for the entire county. We have also added Salt Lake, Weber and

Davis County loss estimations due to their significant amount of expected losses. These loss estimates gives the SHMPC a better understanding of the amount of damage that could be expected after an earthquake and helps us prioritize our mitigation efforts.

<u>Box Elder County</u>
Earthquake loss estimations shown here reflect values taken from the November 2009 Pre-Disaster Mitigation Plan produced by BRAG. The following tables are taken from pages 85 – 88 of the BRAG plan.

Table 6-14: Box Elder County Residential and Commercial Development at Risk in Geological Fault Damage Zones

Jurisdiction	~Residents at Risk*	Residential Units at Risk		Commercial Units at Risk		
		# Units	$ Value**	# Units	$ Value**	$ Potential Revenue Loss***
Brigham City	1,945	604	44,635,719	5	517,600	4,394,735
Deweyville	6	2	115,610	0	0	0
Honeyville	64	20	1,470,228	0	0	0
Perry	544	169	20,720,430	1	1,630,700	878,947
Willard	26	8	694,026	0	0	0
Unincorporated	225	70	6,173,848	2	196,000	1,757,894

Notes: All residential and commercial units and values were derived from Box Elder County parcel data.

*Based on average persons per household for Box Elder County from 2000 Census data, which is 3.22. Numbers were adjusted for multi-family residential units accordingly.

**Current Market Value. Mean (average) current market values were used for structures where values were absent. Values were based on means for each respective building type, i.e. duplex, single family residential, townhouse, etc.

***Derived from 2002 Survey of Business Owners for Box Elder County, US Census Bureau. Average firm receipts totaled $878,947.

Communities not listed do not have any potential residential or commercial losses according to this assessment.

Table 6-15: Box Elder County - Other Facilities at Risk in Geological Fault Damage Zones						
Jurisdiction	Critical Facilities	Roads			Rail Lines	
		Type	Miles	$ Value*	Miles	$ Value**
Brigham City	Brigham City Community Hospital, Box Elder High School, Brigham City Emergency Services facility ($5 Million)	SH	0.8	4,620,906	0.1	85,195
Honeyville	None	SH	1.0	6,021,204	0	0
Perry	None	IH	0.1	633,789	1.8	2,815,026
Willard	None	IH	0.3	2,747,367	0.6	972,714
Unincorporated	None	IH	3.3	30,023,874	4.7	7,369,284
		SH	1.7	10,383,342		

IH = Interstate Highway (6 lanes), SH = State Highway (4 lanes), PLR = Paved Local Roads (2 lanes)

*Average building cost for roads = $1.5 million per lane-mile (Utah's Unified Transportation Plan, 2007-2030, UDOT & Utah MPO's)

**Average building cost for rail lines = $300.00 per foot, minimum, or $1,584,000 per mile, minimum (Jim Marshall, Manager Special Projects Industry & Public, Union Pacific Railroad, Utah, personal communication)

Communities not listed do not have any potential losses according to this assessment.

Table 6-16: Box Elder County Residential and Commercial Development at Risk from Liquefaction						
Jurisdiction	~Residents at Risk*	Residential Units at Risk		Commercial Units at Risk		
		# Units	$ Value**	# Units	$ Value**	$ Potential Revenue Loss***
Bear River	847	263	17,428,420	0	0	0
Brigham City	1,114	346	26,797,509	62	21,170,168	54,494,714
Corinne	644	200	11,090,086	12	5,404,580	10,547,364
Deweyville	351	109	6,504,928	0	0	0
Elwood	895	278	23,942,074	3	934,000	2,636,841
Fielding	374	116	7,231,952	1	78,200	878,947
Garland	592	184	8,880,352	37	5,822,159	32,521,039
Honeyville	564	175	13,887,956	0	0	0
Perry	725	225	24,775,758	5	8,750,400	4,394,735
Tremonton	2,183	678	39,461,078	173	122,799,531	152,057,831
Willard	441	137	14,159,512	3	498,400	2,636,841
Unincorporated	4,405	1,368	98,890,728	20	2,209,788	17,578,940

Notes: All residential and commercial units and values were derived from Box Elder County parcel data.

*Based on average persons per household for Box Elder County from 2000 Census data, which is 3.22. Numbers were adjusted for multi-family residential units accordingly.

**Current Market Value. Mean (average) current market values were used for structures where values were absent. Values were based on means for each respective building type, i.e. duplex, single family residential, townhouse, etc.

***Derived from 2002 Survey of Business Owners for Box Elder County, US Census Bureau. Average firm receipts totaled $878,947.

Communities not listed do not have any potential residential or commercial losses according to this assessment.

Table 6-17: Box Elder County - Other Facilities at Risk from Liquefaction						
Jurisdiction	Critical Facilities	Roads			Rail Lines	
		Type	Miles	$ Value*	Miles	$ Value**
Bear River	Century Elementary School	SH	2.2	13,363,866	0	0
Brigham City	Box Elder County Sheriff, Discovery Elementary School, Brigham City Public Works/Fleet Management Yard, Waste Treatment Facility ($80 Million)	IH	4.0	36,434,349	8.9	14,083,140
		SH	2.7	16,423,668		
Corinne	Corinne Fire Station, Corinne Elementary School	SH	3.1	18,802,278	3.6	5,770,401
Deweyville	None	SH	2.9	17,336,724	4.2	6,666,681
Elwood	None	IH	2.9	26,231,553	3.5	5,495,313
		SH	3.8	22,984,296		
Fielding	Fielding Fire Station, Fielding Elementary School	PLR	0.2	743,391	0	0
		SH	0.9	5,125,224		
Garland	Garland Police Department, Garland Fire Department, Bear River Middle School, Bear River High School, North Community High School	IH	0.5	4,821,678	3.6	5,654,067
		SH	0.1	328,644		
Honeyville	Honeyville Fire Station	IH	3.7	33,693,831	7.3	11,621,900
		SH	1.7	9,993,228		
Perry	None	IH	3.0	26,660,592	5.5	8,632,928
		SH	0.4	2,130,222		
Tremonton	Bear River Valley Hospital, Tremonton Police Department, Tremonton Fire Department, Harris Intermediate School, North Park Elementary School, McKinley Elementary School	IH	3.1	28,047,123	5.1	8,024,706
		PLR	0.5	1,363,566		
		SH	4.0	23,942,784		
Willard	Willard Police Department, Willard Fire Department	IH	3.5	31,773,654	6.6	10,521,223
		SH	0.8	4,596,696		
Unincorporated	None	IH	12.3	110,390,193	45.6	72,216,076
		PLR	9.0	26,902,128		
		SH	43.4	260,157,276		

IH = Interstate Highway (6 lanes), SH = State Highway (4 lanes), PLR = Paved Local Roads (2 lanes)

*Average building cost for roads = $1.5 million per lane-mile (Utah's Unified Transportation Plan, 2007-2030, UDOT & Utah MPO's)

**Average building cost for rail lines = $300.00 per foot, minimum, or $1,584,000 per mile, minimum (Jim Marshall, Manager Special Projects Industry & Public, Union Pacific Railroad, Utah, personal communication)

Communities not listed do not have any potential losses according to this assessment.

Cache County

Earthquake loss estimations shown here reflect values taken from the November 2009 Pre-Disaster Mitigation Plan produced by BRAG. The following tables are taken from pages 146 – 149 of the BRAG plan.

Table 8-14: Cache County Residential and Commercial Development at Risk in Geological Fault Damage Zones

Jurisdiction	~Residents at Risk*	Residential Units at Risk		Commercial Units at Risk		
		# Units	$ Value**	# Units	$ Value**	$ Potential Revenue Loss***
Cornish	10	3	751,346	0	0	0
Hyde Park	168	52	12,890,389	0	0	0
Hyrum	3	1	279,600	0	0	0
Logan	262	81	25,258,683	0	0	0
Mendon	87	27	5,384,000	0	0	0
Millville	3	1	104,186	0	0	0
North Logan	311	96	33,582,355	0	0	0
Providence	19	6	3,186,733	1	74,600	691,653
Smithfield	807	249	53,180,718	0	0	0
Trenton	32	10	1,411,565	0	0	0
Wellsville	165	51	11,212,782	1	40,000	691,653
Unincorporated	470	145	26,931,849	3	168,901	2,074,959

Notes: All residential and commercial units and values were derived from Cache County parcel data.

*Based on average persons per household for Cache County from 2000 Census data, which is 3.24. Numbers were adjusted for multi-family residential units accordingly.

**Current Market Value

***Derived from 2002 Survey of Business Owners for Cache County, US Census Bureau. Average firm receipts totaled $691,653.

Communities not listed do not have any potential residential or commercial losses according to this assessment.

Table 8-15: Cache County - Other Facilities at Risk in Geological Fault Damage Zones						
Jurisdiction	Critical Facilities	Roads			Rail Lines	
		Type	Miles	$ Value*	Miles	$ Value**
Logan	none	SH	0.2	1,362,432	0	0
Mendon	none	PLR	0.1	346,389	0	0
Trenton	none	SH	0.7	4,450,344	0.7	1,164,630
Wellsville	none	SH	0.2	1,140,582	0	0
Unincorporated	none	PLR	1.6	4,799,853	1.3	2,019,850
		SH	2.2	13,060,896	0	0

IH = Interstate Highway (6 lanes), SH = State Highway (4 lanes), PLR = Paved Local Roads (2 lanes)

*Average building cost for roads = $1.5 million per lane-mile (Utah's Unified Transportation Plan, 2007-2030, UDOT & Utah MPO's)

**Average building cost for rail lines = $300.00 per foot, minimum, or $1,584,000 per mile, minimum (Jim Marshall, Manager Special Projects Industry & Public, Union Pacific Railroad, Utah, personal communication)

Communities not listed do not have any potential losses according to this assessment.

Table 8-16: Cache County Residential and Commercial Development at Risk from Liquefaction (Utah State University and Utah Geological Survey Data, 1994 - Countywide)						
Jurisdiction	~Residents at Risk*	Residential Units at Risk		Commercial Units at Risk		
		# Units	$ Value**	# Units	$ Value**	$ Potential Revenue Loss***
Amalga	81	25	3,803,631	1	8,904,160	691,653
Cornish	29	9	1,235,234	0	0	0
Hyrum	3	1	27,135	0	0	0
Lewiston	29	9	1,832,025	0	0	0
Logan	8,712	2,689	244,321,327	120	72,293,304	82,998,360
Millville	6	2	290,173	7	5,464,280	4,841,571
Nibley	1,464	452	66,036,199	6	5,456,400	4,149,918
Providence	492	152	34,942,707	29	24,850,667	20,057,937
River Heights	136	42	5,414,354	0	0	0
Trenton	36	11	1,031,749	0	0	0
Unincorporated	914	282	43,454,665	6	1,206,610	4,149,918
Wellsville	363	112	13,995,690	3	465,077	2,074,959

Notes: All residential and commercial units and values were derived from Cache County parcel data.

*Based on average persons per household for Cache County from 2000 Census data, which is 3.24. Numbers were adjusted for multi-family residential units accordingly.

**Current Market Value

***Derived from 2002 Survey of Business Owners for Cache County, US Census Bureau. Average firm receipts totaled $691,653.

Communities not listed do not have any potential residential or commercial losses according to this assessment.

Table 8-17: Cache County - Other Facilities at Risk from Liquefaction (Utah State University and Utah Geological Survey Data, 1994 - Countywide)						
Jurisdiction	**Critical Facilities**	**Roads**			**Rail Lines**	
		Type	**Miles**	**$ Value***	**Miles**	**$ Value****
Amalga	None	PLR	0.4	1,131,543	0	0
		SH	0.1	770,970		
Cornish	None	SH	0.1	541,074	0.3	507,637
Lewiston	None	SH	0.6	3,668,910	0.2	268,767
Logan	Logan South Campus High School, Wilson Elementary School	PLR	0.6	1,742,559	2.3	3,590,114
		SH	3.2	19,300,326		
Millville	None	SH	0.8	4,529,652	0	0
Nibley	None	SH	1.7	9,983,196	1.3	2,002,841
Providence	None	SH	0.5	3,183,858	0	0
River Heights	None	SH	0.05	271,038	0	0
Trenton	None	SH	1.2	7,327,200	0	0
Wellsville	None	SH	0.4	2,141,862	0.5	791,723
Unincorporated	None	PLR	4.2	12,734,061	1.6	2,553,280
		SH	3.1	18,695,724		

IH = Interstate Highway (6 lanes), SH = State Highway (4 lanes), PLR = Paved Local Roads (2 lanes)

*Average building cost for roads = $1.5 million per lane-mile (Utah's Unified Transportation Plan, 2007-2030, UDOT & Utah MPO's)

**Average building cost for rail lines = $300.00 per foot, minimum, or $1,584,000 per mile, minimum (Jim Marshall, Manager Special Projects Industry & Public, Union Pacific Railroad, Utah, personal communication)

Communities not listed do not have any potential losses according to this assessment.

Table 8-18: Cache County Residential and Commercial Development at Risk from Liquefaction (Utah Geological Survey Data, 2001 - Newton, Wellsville, Smithfield, and Logan Quadrangles Only)						
Jurisdiction	**~Residents at Risk***	**Residential Units at Risk**		**Commercial Units at Risk**		
		# Units	**$ Value****	**# Units**	**$ Value****	**$ Potential Revenue Loss*****
Logan	2,330	719	73,951,112	22	18,283,661	15,216,366
Mendon	0	0	0	1	171,480	691,653
Millville	3	1	149,500	7	5,464,280	4,841,571
Newton	120	37	4,495,742	0	0	0
Nibley	78	24	3,673,208	0	0	0
Providence	3	1	677,200	0	0	0

Notes: All residential and commercial units and values were derived from Cache County parcel data. Only municipalities that had parcels overlapping high liquefaction areas were analyzed. Unincorporated parcels were not included in this analysis, because of incomplete liquefaction data outside of the above mentioned quadrangles.

*Based on average persons per household for Cache County from 2000 Census data, which is 3.24. Numbers were adjusted for multi-family residential units accordingly.

**Current Market Value

***Derived from 2002 Survey of Business Owners for Cache County, US Census Bureau. Average firm receipts totaled $691,653.

Communities not listed do not have any potential residential or commercial losses according to this assessment.

Table 8-19: Cache County - Other Facilities at Risk from Liquefaction (Utah Geological Survey Data, 2001 - Newton, Wellsville, Smithfield, and Logan Quadrangles Only)						
Jurisdiction	Critical Facilities	Roads			Rail Lines	
		Type	Miles	$ Value*	Miles	$ Value**
Logan	none	SH	0.5	2,863,476	1.5	2,306,350
Mendon	none	0	0	0	0.1	136,416
Millville	none	SH	0.1	458,952	0	0
Newton	none	SH	0.1	590,880	0	0

IH = Interstate Highway (6 lanes), SH = State Highway (4 lanes), PLR = Paved Local Roads (2 lanes)

*Average building cost for roads = $1.5 million per lane-mile (Utah's Unified Transportation Plan, 2007-2030, UDOT & Utah MPO's)

**Average building cost for rail lines = $300.00 per foot, minimum, or $1,584,000 per mile, minimum (Jim Marshall, Manager Special Projects Industry & Public, Union Pacific Railroad, Utah, personal communication)

Communities not listed do not have any potential losses according to this assessment.

Salt Lake County

Category	Number of Structures with > 50% Damage		Category	Estimated Losses	
	Salt Lake M5.9	2500-yr M7.1		Salt Lake M5.9	2500-yr M7.1
Residential	30,342	157,705	Structural Losses	$519,320,000	$3,419,030,470
Commercial	1,896	5,199	Non-Structural Losses	$1,818,647,000	$12,331,504,070
Industrial	495	1,367	Content Losses	$719,709,000	$4,114,455,740
Government	167	475	Inventory Losses	$29,216,000	$175,756,410
Education	51	159	Income and Relocation Losses	$623,140,000	$3,263,449,580
Totals	32,951	164,905	Totals	**$3,710,032,000**	**$23,304,196,270**

Table 11-3. Building Damage Counts and Estimated Losses

Night Event	Salt Lake M5.9	2500-yr M7.1	Day Event	Salt Lake M5.9	2500-yr M7.1	Commute Event	Salt Lake M5.9	2500-yr M7.1
Minor	1,024	10,475	**Minor**	1,883	17,110	**Minor**	1,432	13,442
Major	219	3,224	**Major**	502	6,192	**Major**	369	4,688
Fatalities	44	758	**Fatalities**	122	1,742	**Fatalities**	87	1,258

Table 11-7. Casualties

Davis County

Category	Number of Structures with >50% Damage		Category	Estimated Losses	
	Davis M5.9	2500-yr M7.1		Davis M5.9	2500-yr M7.1
Residential	7,618	41,310	Structural Losses	$96,362,000	$751,502,550
Commercial	282	954	Non-Structural Losses	$345,379,000	$2,646,616,900
Industrial	91	294	Content Losses	$131,812,000	$844,568,670
Government	15	49	Inventory Losses	$4,504,000	$38,314,060
Education	11	38	Income and Relocation Losses	$90,090,000	$3,983,479,080
Totals	**8,017**	**42,645**	Totals	**$668,147,000**	**$8,264,481,260**

Table 9-3. Building Damage Counts and Estimated Losses

Night Event	Davis M5.9	2500-yr M7.1	Day Event	Davis M5.9	2500-yr M7.1	Commute Event	Davis M5.9	2500-yr M7.1
Minor	223	2,589	*Minor*	250	3,039	*Minor*	227	2,700
Major	46	792	*Major*	62	1,086	*Major*	59	924
Fatalities	9	186	*Fatalities*	14	302	*Fatalities*	13	243

Table 9-7. Casualties

Weber County

Category	Number of Structures with > 50% Damage		Category	Estimated Losses	
	Weber M5.9	2500-yr M7.1		Weber M5.9	2500-yr M7.1
Residential	9,628	36,944	Structural Losses	$121,246,000	$606,962,750
Commercial	402	921	Non-Structural Losses	$427,644,000	$2,131,644,450
Industrial	94	233	Content Losses	$160,762,000	$683,297,620
Government	36	78	Inventory Losses	$5,829,000	$30,625,560
Education	15	35	Income and Relocation Losses	$134,323,000	$537,906,150
Totals	**10,175**	**38,211**	**Totals**	**$849,804,000**	**$3,990,436,530**

Table 13-4. Building Damage Counts and Estimated Losses

Night Event	Weber M5.9	2500-yr M7.1	Day Event	Weber M5.9	2500-yr M7.1	Commute Event	Weber M5.9	2500-yr M7.1
Minor	294	2,076	**Minor**	434	2,797	**Minor**	349	2,313
Major	67	636	**Major**	119	996	**Major**	93	793
Fatalities	14	150	**Fatalities**	29	276	**Fatalities**	22	210

Table 13-8. Casualties